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Blunt Traumatic Thoracic Aortic Pseudoaneurysm in a Young Adult.

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ABSTRACT

Blunt thoracic aortic injury (BTAI) is a rare but potentially fatal complication of high-energy trauma. Management can be particularly challenging in polytraumatized patients when severe concomitant injuries require immediate treatment.

We report the case of a 27-year-old motorcyclist who was struck by a car and underwent whole-body trauma CT. Thoracic CT angiography demonstrated a focal pseudoaneurysm of the thoracic aorta located 48 mm distal to the origin of the left subclavian artery and measuring $20 \times 7.5 \times 21$ mm, consistent with a grade III BTAI. No mediastinal hematoma or CT evidence of free aortic rupture was identified. Abdominal CT additionally revealed AAST grade V splenic avulsion associated with a large-volume hemoperitoneum. Given the immediate hemorrhagic risk related to the splenic injury, emergency splenectomy was prioritized. After surgical stabilization, the aortic injury was successfully treated by thoracic endovascular aortic repair (TEVAR). Final angiography demonstrated satisfactory stent-graft positioning and complete exclusion of the pseudoaneurysm.

This case highlights the crucial role of whole-body CT in the comprehensive assessment of polytrauma and illustrates the importance of individualized therapeutic prioritization when multiple life-threatening injuries coexist. In selected patients without evidence of free aortic rupture, treatment of an immediately threatening hemorrhagic injury may precede definitive endovascular aortic repair.

KEYWORDS

Blunt thoracic aortic injury; Traumatic pseudoaneurysm; Aortic isthmus; Splenic avulsion; Polytrauma; TEVAR; Computed tomography

MAIN ARTICLE

INTRODUCTION:

Blunt thoracic aortic injury (BTAI) is a rare but potentially fatal complication of high-energy trauma, most commonly resulting from rapid deceleration mechanisms such as motor vehicle collisions. The aortic isthmus, located immediately distal to the origin of the left subclavian artery, represents the most frequently affected site because of its relative fixation and exposure to shearing forces during sudden deceleration.

Computed tomography angiography (CTA) plays a pivotal role in the rapid diagnosis and characterization of these injuries in hemodynamically stable patients. Traumatic aortic pseudoaneurysm represents a severe form of BTAI and generally requires definitive repair, with thoracic endovascular aortic repair (TEVAR) having largely replaced open surgery in suitable patients.

Management may become particularly challenging in polytraumatized patients presenting with concomitant life-threatening hemorrhagic injuries, in whom therapeutic priorities must be carefully individualized. We report the case of a 27-year-old motorcyclist presenting with a traumatic thoracic aortic pseudoaneurysm associated with severe splenic avulsion, successfully managed by emergency splenectomy followed by endovascular aortic repair

CASE REPORT:

A 27-year-old man was admitted to the emergency department following a high-energy road traffic accident. The patient was a motorcyclist who had been struck by a car. As part of the initial assessment of this polytrauma patient, a whole-body trauma CT scan was performed, including a non-contrast head CT and a thoraco-abdominopelvic CT acquired before contrast administration and after intravenous contrast injection during the arterial, portal venous, and delayed phases.

Thoracic CT angiography revealed a focal pseudoaneurysm of the thoracic aorta, located 48 mm distal to the origin of the left subclavian artery and measuring $20 \times 7.5 \times 21$ mm. No associated mediastinal hematoma or other CT evidence of free aortic rupture was observed. These findings were consistent with a grade III blunt thoracic aortic injury (Fig. 1)

Abdominal CT demonstrated a severe splenic injury with extensive parenchymal disruption and devascularization, consistent with traumatic splenic avulsion (AAST grade V), associated with a large-volume hemoperitoneum. Given the severity of the splenic injury and the major hemorrhagic risk, priority was given to surgical management, and the patient underwent emergency splenectomy. Following surgical stabilization, definitive treatment of the traumatic aortic injury was undertaken (Fig. 2).

Given the severity of the splenic injury and the immediate hemorrhagic risk, priority was given to surgical control of the abdominal injury. The patient underwent emergency splenectomy. Following surgical stabilization, definitive treatment of the traumatic aortic injury was undertaken.

Thoracic endovascular aortic repair (TEVAR) was subsequently performed. Intraoperative angiography confirmed the aortic isthmus injury, and a covered thoracic stent graft was deployed across the injured segment. Final angiographic assessment demonstrated satisfactory positioning of the endograft and exclusion of the traumatic pseudoaneurysm (Fig. 3).

Follow-up thoracic CT angiography confirmed satisfactory positioning and patency of the endograft, with complete exclusion of the pseudoaneurysm and no evidence of endoleak or thrombosis (Fig. 4).

DISCUSSION:

Blunt thoracic aortic injury (BTAI) is an uncommon but potentially fatal consequence of high-energy trauma, most frequently resulting from motor vehicle collisions and rapid deceleration mechanisms [1,2]. The underlying pathophysiology involves a combination of shearing, stretching, and torsional forces acting on the thoracic aorta during abrupt deceleration. The aortic isthmus, located immediately distal to the origin of the left subclavian artery, is the most frequently affected site because it represents a transition between the relatively mobile aortic arch and the more fixed descending thoracic aorta [1,3]. In our patient, both the mechanism—a motorcyclist struck by a car—and the location of the pseudoaneurysm were therefore characteristic of BTAI.

In hemodynamically stable polytrauma patients, computed tomography angiography (CTA) is the imaging modality of choice, allowing rapid diagnosis and characterization of the aortic injury while simultaneously identifying associated traumatic lesions [2,3]. Direct CT findings of BTAI include intimal tears or flaps, intramural hematoma, focal contour abnormality, pseudoaneurysm, and active contrast extravasation, whereas mediastinal or periaortic hematoma represents an important indirect sign [3]. In our case, CTA demonstrated a focal thoracic aortic pseudoaneurysm measuring $20 \times 7.5 \times 21$ mm, located 48 mm distal to the origin of the left subclavian artery, without associated mediastinal hematoma or other CT evidence of free aortic rupture.

According to the Society for Vascular Surgery grading system, BTAI is classified into four grades: grade I, intimal tear; grade II, intramural hematoma; grade III, pseudoaneurysm; and grade IV, free rupture [1,4]. Accordingly, the lesion observed in our patient was classified as a grade III BTAI. Higher-grade injuries, particularly grades III and IV, generally require definitive repair because of their greater risk of adverse aortic events [1,4].

Beyond diagnosis, CTA plays a crucial role in endovascular treatment planning. Precise assessment of lesion morphology and location, aortic caliber, and particularly the relationship between the injured segment and the origin of the left subclavian artery is essential for determining adequate proximal and distal landing zones and selecting an appropriately sized stent graft [1,2]. In our patient, the proximal margin of the pseudoaneurysm was located 48 mm distal to the left subclavian artery origin, providing an important anatomical parameter for planning endovascular exclusion.

A major feature of the present case was the coexistence of two potentially life-threatening traumatic injuries. In addition to the grade III aortic injury, whole-body CT demonstrated severe splenic trauma with avulsion and extensive devascularization, associated with a large-volume hemoperitoneum, corresponding to an AAST grade V splenic injury [5,6]. This association illustrates the major role of whole-body CT in polytrauma, not only for lesion detection but also for determining therapeutic priorities.

The coexistence of these two severe injuries raised an important issue regarding therapeutic prioritization. Management of BTAI in polytrauma patients should take into account the grade of aortic injury, hemodynamic status, imaging signs suggesting impending or free rupture, and the presence of other immediately life-threatening injuries. In appropriately

selected stable patients, definitive aortic repair may be delayed to allow stabilization and treatment of severe concomitant injuries [1,2,4]. In our patient, the absence of imaging evidence of free aortic rupture, combined with an AAST grade V splenic avulsion and large-volume hemoperitoneum, favored initial control of the intra-abdominal hemorrhagic emergency. Emergency splenectomy was therefore performed first, followed by TEVAR after surgical stabilization. This staged approach illustrates the importance of individualized management in polytrauma patients rather than basing therapeutic priority solely on the anatomical grade of the aortic injury.

Thoracic endovascular aortic repair (TEVAR) has largely replaced conventional open surgical repair in anatomically suitable patients with significant BTAI. Compared with open repair, TEVAR avoids thoracotomy and aortic cross-clamping and is associated with reduced perioperative morbidity and mortality [1,2]. In our patient, intraoperative aortography confirmed the traumatic pseudoaneurysm, and successful exclusion was achieved by deployment of a covered thoracic stent graft. Final angiographic assessment demonstrated satisfactory positioning of the endograft and complete exclusion of the pseudoaneurysm without immediate angiographic complication.

Finally, the young age of our patient deserves particular consideration, as trauma patients undergoing TEVAR have a long life expectancy and may therefore be exposed to potential late device-related complications. Follow-up CT angiography in our patient confirmed satisfactory positioning and patency of the endograft, with complete exclusion of the pseudoaneurysm and no evidence of endoleak or thrombosis. Nevertheless, long-term imaging surveillance remains important after TEVAR to assess endograft integrity and detect potential delayed complications, including endoleak, migration, collapse, thrombosis, or changes in aortic morphology. [2].

CONCLUSION:

Blunt thoracic aortic injury is a potentially fatal complication of high-energy deceleration trauma requiring prompt diagnosis and appropriate therapeutic planning. Whole-body CT plays a central role not only in identifying and grading the aortic injury but also in detecting associated life-threatening lesions and guiding their therapeutic prioritization. In our patient, the coexistence of a grade III thoracic aortic pseudoaneurysm and an AAST grade V splenic avulsion with large-volume hemoperitoneum required a staged approach, with emergency

splenectomy followed by successful TEVAR after stabilization. This case emphasizes the importance of individualized, multidisciplinary management of polytrauma patients, in whom treatment priorities should be determined by the immediate threat posed by each injury rather than by anatomical severity alone

FIGURES :

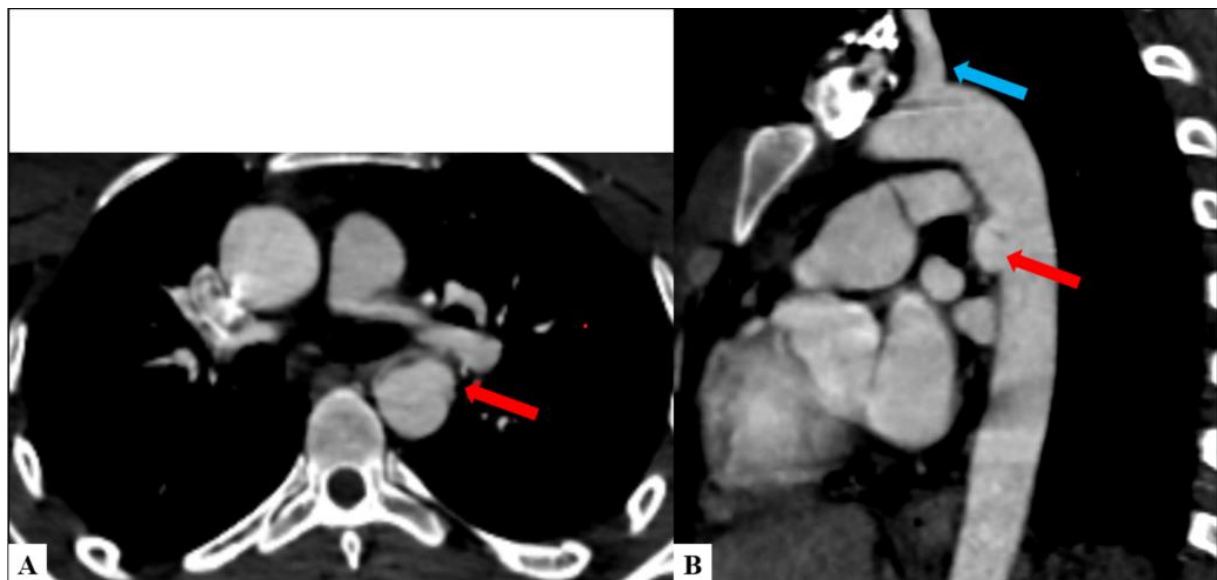


Figure 1: Thoracic CT angiography, arterial-phase axial (A) and sagittal (B) images demonstrate a focal pseudoaneurysm of the thoracic aorta (red arrow) distal to the origin of the left subclavian artery (blue arrow), consistent with a grade III blunt thoracic aortic injury.

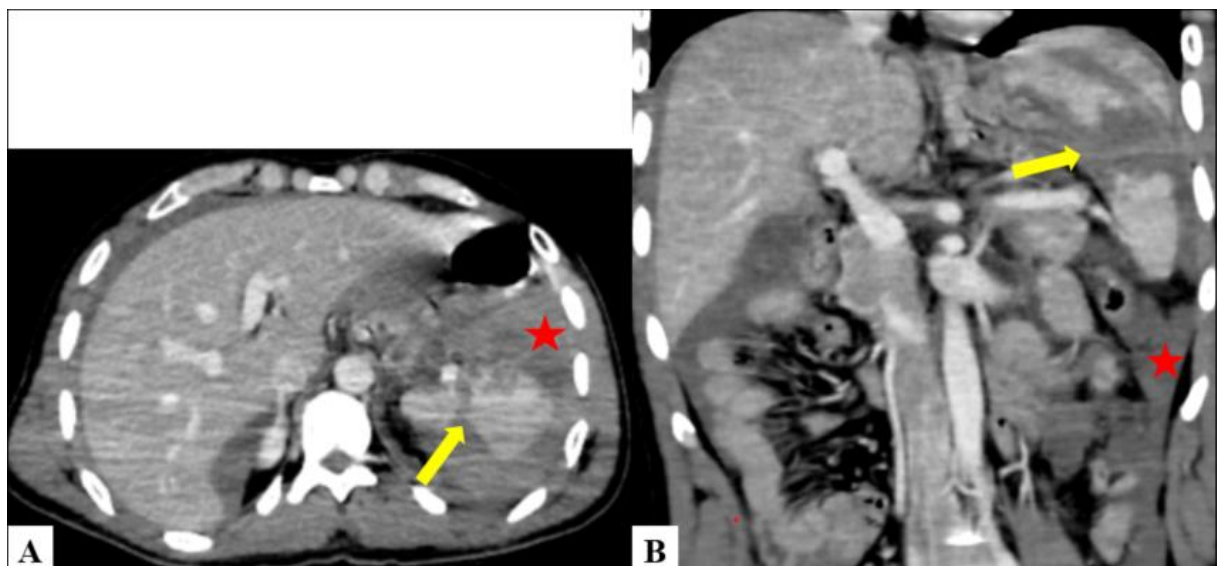


Figure 2: Abdominal CT angiography, Axial (A) and coronal (B) contrast-enhanced CT images showing severe disruption of the spleen (yellow arrow) consistent with splenic avulsion, associated with a large-volume hemoperitoneum (red star).



Figure 3: Pre-treatment thoracic aortography (A) demonstrating the traumatic pseudoaneurysm before stent-graft deployment (red arrow) and post-treatment angiographic image (B) showing the thoracic endograft in place with exclusion of the pseudoaneurysm.

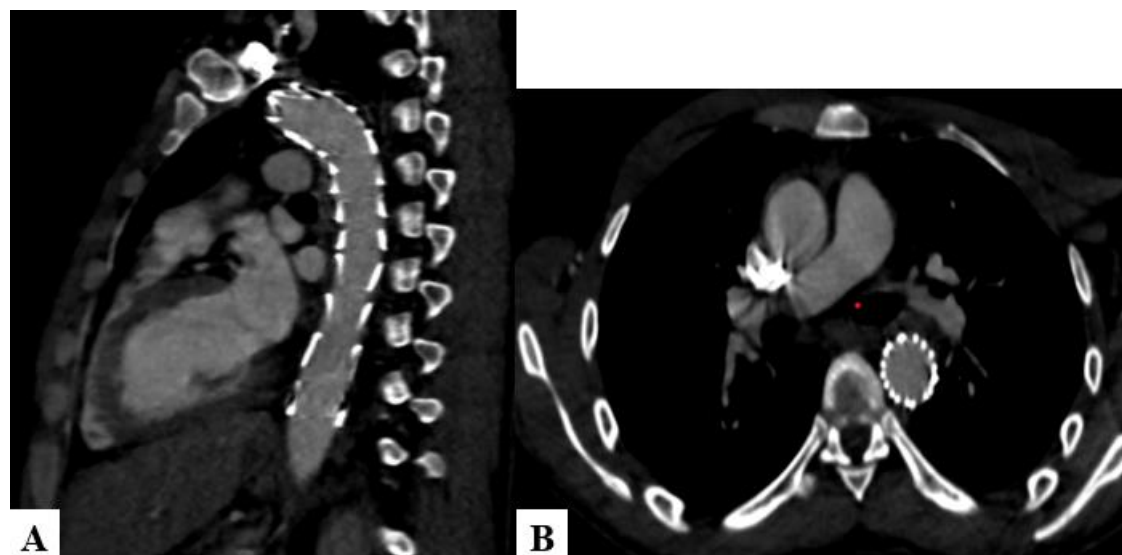


Figure 4. Follow-up CT angiography after TEVAR. Sagittal (A) and axial (B) contrast-enhanced CT images demonstrating the thoracic endograft in satisfactory position, with preserved patency and complete exclusion of the traumatic pseudoaneurysm, without evidence of endoleak or thrombosis.

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Availability of data and materials: All data underlying the findings are fully available.

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Consent for publication: The patient(s) gave his written consent to use his personal data for the publication of this case report and any accompanying images.

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